भारतीय मानक
Indian Standard

IS 15683 : 2018

सुबाह्य अग्नि शामक — कार्यकारिता और निर्माण — विशिष्टि

(पहला पुनरीक्षण)

Portable Fire Extinguishers — Performance and Construction — Specification

(First Revision)

ICS 13.220.10

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Fire Fighting Sectional Committee, CED 22

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Fire Fighting Sectional Committee had been approved by the Civil Engineering Division Council.

This standard was first published in 2006. The standard covered various types of portable fire extinguishers. Consequently, subsequent to the publication of this standard, the individual separate Indian Standards for various portable fire extinguisher namely, water type (gas cartridge) (IS 940 : 2003); dry powder (cartridge type) (IS 2171: 1999); water type (stored pressure) (IS 6234 : 2003); mechanical foam type (IS 10204 : 2001); dry powder type (stored pressure) (IS 13849 : 1993); and mechanical foam type (stored pressure) (IS 15397 : 2003), were withdrawn. There were five amendments issued to the standard. The standard has been revised to incorporate all the amendments suitably and to make it user friendly with a view to facilitating the industry and the users in the implementation of this standard while incorporating a number of other improvements.

The following are the significant modifications incorporated in this revision:

a) Water mist type of fire extinguisher has been introduced;
b) The recommended capacities of various types of fire extinguishers have been modified;
c) Maximum operating temperature of all types of fire extinguishers has been increased from 55 °C to 60 °C;
d) Test method for Class F (kitchen fire) has been specified;
e) A new material for construction of fire extinguishers body in the form of composite material has been introduced; and
f) Requirements of extinguishants have been specified.

The details with regard to installation and maintenance are given in IS 2190 : 2010 ‘Code of practice for selection, installation and maintenance of first-aid fire extinguishers’.

While formulating this standard necessary guidance has been derived from ISO 7165 : 2009 ‘Fire fighting — Portable fire extinguishers — Performance and construction’.

The composition of the Committee responsible for formulation of the standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PORTABLE FIRE EXTINGUISHERS — PERFORMANCE AND CONSTRUCTION — SPECIFICATION

(First Revision)

1 SCOPE

This standard lays down requirements for performance, reliability and safety of portable fire extinguishers of the following types :

a) Water based;
b) Foam based;
c) Powders — ABC/BC/D Type;
d) Carbon dioxide;
e) Clean agents; and
f) Water mist type.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated at Annex A.

3 TERMINOLOGY

For the purposes of these standard, definitions given in IS 7673, and the following definitions shall apply.

3.1 Classification of Fires

3.1.1 *Class A* — Fires involving solid combustible materials of organic nature such as wood, paper, rubber, plastics, etc, where the cooling effect of water is essential to extinguish the fire.

3.1.2 *Class B* — Fires involving flammable liquids or liquefiable solids or the like where a blanketing effect is essential to extinguish the fire.

3.1.3 *Class C* — Fires involving flammable gases under pressure including liquefied gases, where it is necessary to inhibit the burning gas at fast rate with an inert gas, powder or vaporizing liquid for extinguishment.

3.1.4 *Class D* — Fires involving combustible metals such as magnesium, aluminium, zinc, sodium, potassium, etc, when the burning metals are reactive to water containing agents and in certain cases carbon dioxide, halogenated hydrocarbons and ordinary dry powders. These fire require special media and techniques to extinguish.

3.1.5 *Class F* — Fires involving cooking media (vegetable or animal oils and fats) in cooking appliances and may be called kitchen fire.

3.2 Portable Extinguisher — Portable fire extinguishers are not expected to deal with large fires. Nevertheless, these are very valuable in the early stages of fire. The most important features of these extinguishers are immediately available and can be used by one/two person(s). The weight of a fully charged portable fire extinguishers shall not be more than 17 kg. The extinguishing medium is discharged and directed into fire by stored pressure or release of pressure from gas cartridge.

3.3 Extinguishing Medium — Substance contained in the extinguisher that causes fire extinguishment such as water, foam, powder, carbondioxide, clean agent, water mist, etc.

3.4 Charge of Extinguisher — Mass (kg) or volume (litres), of the extinguishing medium contained in the extinguisher expressed in volume for water based extinguishers and in kg for gaseous and powder extinguishers.

3.5 Service Pressure (P_s) — Equilibrium pressure developed in a normally charged and pressurized extinguisher conditioned at 27 ± 5°C for at least 18 h stored pressure or pressure generated during actuation of gas cartridge. An extinguisher is termed as low pressure extinguisher if its service pressure is less than or equal to 19 bar. If its service pressure is above 19 bar the extinguisher is termed as high pressure extinguisher.

3.6 Maximum Service Pressure (P_{ms}) — Equilibrium pressure developed in a normally charged and pressurized extinguisher which is conditioned at 55 ± 5°C for at least 18 h.

3.7 Complete Discharge of Extinguishing Medium in Percentage and Time — Point in the discharge of an extinguisher when the internal pressure has equalized with the external pressure, with the valve control being kept fully open.

3.8 Effective Discharge Time — Time measured from the commencement of discharge of the extinguishing medium at the nozzle to the point of the discharge stream with the control valve fully open when 85 percent of extinguishing medium is discharged in case of powder and 95 percent in case of water, foam, carbon dioxide, clean agent and water mist type extinguishers.

3.9 Rechargeable Extinguisher — Extinguisher designed to be recharged after use.

3.10 Disposable Extinguisher (Non-rechargeable Extinguisher) — Extinguisher designed not to be recharged, but intended to be discarded after use.

3.11 Fill Density — Mass in kg, of extinguishing medium per litre of container volume for use, complete with valve and internal fittings.

3.12 Propellant — Non-flammable compressed gas used to expel the extinguishing medium that is carbondioxide (CO_2), nitrogen (N_2) and air.

3.13 Clean Agent — Electrically non-conductive gaseous or vaporizing liquid fire extinguishant that does not leave a residue upon evaporation and are not toxic to level of concentration at which it extinguishes the fire.

4 CLASSIFICATION OF EXTINGUISHERS

Extinguishers shall be classified by the type of extinguishing medium which they contain. At present, the main types of extinguishers are:

a) Water based;
b) Foam based;
c) Powders — ABC/BC/D Type;
d) Carbon dioxide;
e) Clean agents; and
f) Water mist type

NOTES

1 These types of extinguishers may be further sub-divided, for example water-based extinguishers may contain pure water or water with additives such as wetting agents, viscosity-increasing agents, flame-retardant, etc.

2 Powders may be of the 'BC' or 'ABC' or 'D' (metals) type.

3 The manufacture and use of clean agents which are halon substitutes such as HFC, HCFC, HBFC, their blends and fluoro ketone, etc, are regulated by the Montreal Protocol and/or by national regulations.

5 EXTINGUISHING MEDIA, PROPELLANTS AND FILLING REQUIREMENTS

5.1 Extinguishing Media

5.1.1 *Water and Water Mist*

5.1.2 *Carbon Dioxide*

Carbon dioxide used in extinguishers shall conform to IS 15222.

5.1.3 *Clean Agents*

For clean agent, certificate of manufacturer/supplier shall be made available. Further name of clean agent shall be marked on the label of the extinguishers.

5.1.4 *Powders*

Powder used in the extinguisher shall conform to IS 4308.

5.1.5 *Foam Concentrates*

Foam concentrates used in the extinguishers shall conform to IS 4989.

NOTE — There is no Indian Standard covering non-foaming additives sometimes added to water to produce anti-freeze, wetting or other special characteristics. However, such extinguishers are included in the category of water-based extinguishers, the water-anti-freeze solution shall be tested for its freezing point and thawing. Calcium chloride solution shall not be used for stainless steel fire extinguishers.

5.2 Propellants

The propellants for stored pressure and cartridge-operated extinguishers shall be air, carbon dioxide and nitrogen.

5.3 Filling Requirements (Type Test)

5.3.1 *Fill Density*

The maximum fill density for carbon dioxide extinguishers shall not exceed 0.667 kg/l. The fill density for clean agent fire extinguishers shall not exceed the values given by the supplier/manufacturer of the gas.

5.3.2 *Filling Tolerance*

The actual charge of an extinguisher shall be the nominal charge within the following limits:

a) Water based extinguisher : 0 percent to + 5 percent by volume;
b) Foam based extinguisher : 0 percent to + 5 percent by volume;
c) Powder extinguishers : ± 2 percent by mass;
d) Carbon dioxide extinguishers : 0 percent to + 5 percent by mass;
e) Clean-agent extinguishers : 0 percent to + 5 percent by mass; and
f) Water mist type : 0 percent to + 5 percent by volume.

5.3.3 *Capacities*

The following are the capacities for fire extinguishers:

a) Water (litres) : 2, 3, 4, 6, 9;
b) Foam (litres) : 2, 3, 4, 6, 9;
c) Powder - BC/ABC/D Type (kg) : 1, 2, 4, 6, 9, 12;

d) CO_2 (kg)	:	2, 3, 4.5;
e) Clean agent (kg)	:	2, 4, 6; and
f) Water mist (litres)	:	2, 3, 4, 6, 9

6 PRESSURE REQUIREMENTS FOR LOW PRESSURE EXTINGUISHERS

6.1 Test Pressure (P_t)

The test pressure (P_t) for low-pressure extinguishers shall be 1.43 × P_{ms} but in no case less than 3.5 MPa (35 bar).

6.2 Minimum Burst Pressure (P_b)

The minimum burst pressure (P_b) for low-pressure extinguishers is 2.7 × P_{ms} but in no case less than 5.5 MPa (55 bar).

7 GENERAL OPERATING PERFORMANCE REQUIREMENTS

7.1 Operating Temperature Ranges

Extinguishers shall be capable of operating reliably within one of the following ranges of temperature:

a) + 5°C to + 60°C

b) 0°C to + 60°C

c) − 10°C to + 60°C

d) − 20°C to + 60°C

e) − 30°C to + 60°C

NOTE — The temperature range selected from the above shall be marked on the fire extinguisher (*see* **10.2.1.4**).

7.2 Minimum Effective Discharge Time and Bulk Range of Discharge

7.2.1 *Class A Rated Extinguishers*

7.2.1.1 The minimum effective discharge time of extinguishers with 1A rating shall not be less than 8 s. Extinguishers with ratings of 2A or higher shall have a minimum effective discharge time of 13 s.

7.2.1.2 The minimum bulk range of extinguishers with a class A rating shall not be less than 2 m when determined in accordance with **7.2.3**.

7.2.2 *Class B Rated Extinguishers*

The minimum effective discharge time and bulk range of discharge shall not be less than the values given in Table 1.

7.2.3 *Test Method*

Carry out the test indoors having suitable lighting to give the best possible visibility of the extinguishing medium during discharge. Use a black background marked to indicate the horizontal distance. Condition the extinguisher for not less than 18 h at a temperature of 27 ± 5°C and place it in normal operating position that is, upright with the discharge nozzle held horizontally 1 m above the floor. Fully discharge the extinguisher with the control valve fully open within 5 min of conditioning. Record the bulk range (throw) of the extinguisher as the range at the time corresponding to 50 percent of the effective discharge time that is if discharge time is 15 s, the range should be minimum up to 7.5 s or average maximum throw distance observed visually.

Table 1 Minimum Effective Discharge Time and Bulk Range of Discharge of Class B Rated Extinguishers

(*Clause* 7.2.2)

Sl No. (1)	Classification (2)	Minimum Discharge Time s (3)	Minimum Throw Distance m (4)
i)	8B	8	1
ii)	13B	8	1
iii)	21B	8	2
iv)	34B	8	2
v)	55B	9	2
vi)	(70B)	9	2
vii)	89B	9	2
viii)	(113B)	12	2
ix)	144B	15	2
x)	(183B)	15	2
xi)	233B	15	2

7.3 Resistance to Temperature Changes (Type Test)

7.3.1 *Requirements*

Portable extinguishers shall be able to operate at temperatures within one of the temperature ranges given in **7.1** as indicated by the manufacturer and comply with the following requirements after being subjected to the conditions given in **7.3.2**:

a) Shall operate as intended;

b) Commence discharge within 5 s of the opening of control valve;

c) Following cycle 1, retention of initial charge shall be maximum 15 percent; and

d) Following cycle 2, retention of initial charge shall be maximum 20 percent.

7.3.2 *Test Method*

Subject two extinguishers to the temperature cycles given in Table 2, one extinguisher to each cycle.

Operate the extinguisher within 5 min of its removal from the conditioning chamber.

The extinguisher is to be held in its normal working position and shall remain immobile for the duration of the test.

NOTE — For cartridge operated extinguishers, the cartridge shall be pierced and the pressure allowed to build for 6 s before opening the control valve.

Table 2 Temperature Cycles

(*Clause* 7.3.2)

Sl No.	Duration, h	Cycle 1	Cycle 2
(1)	(2)	(3)	(4)
i)	24 ± 1	Store at minimum[1] stated temperature	Store at (60 ± 5)°C
ii)	24 ± 1	Store at (27 ± 5)°C	Store at (27 ± 5)°C
iii)	24 ± 1	Store at (60 ± 5)°C	Store at minimum[1] stated temperature.

[1] *See* **7.1** temperature range marked on the extinguisher.

NOTE — The storage temperatures refer to the ambient temperature within the conditioning chamber.

7.4 Retention of Charge

7.4.1 *Retention of Charge Following Partial Discharge (Discharge Valve Test)*

7.4.1.1 *Requirements*

Fire extinguishers shall be fitted with a control valve allowing the discharge of the extinguishing medium to be interrupted at any time.

The extinguisher shall be adequately resistant to leakage and the second pressure/weight of contents as appropriate shall be no less than 75 percent of the first, after interruption of the discharge as determined in **7.4.1.2**.

7.4.1.2 *Test method*

Discharge a fully charged extinguisher for a period equal to half the time for total discharge and the control valve shall then be closed. Measure the internal pressure (or weight of contents as appropriate) and after a further 5 min with the valve having remained closed, measure the pressure (or weight of contents as appropriate) again. For checking the initial pressure and final pressure, attachment of a suitable digital pressure gauge is to be made with the discharge passage of valve of the extinguishers.

7.4.2 *Leakage Test (Type Test)*

Each stored pressure fire extinguisher including valve assembly shall be dipped in suitable water tank filled with water, to the level more than the height of extinguisher and then a funnel with close narrow end made of transparent glass or transparent plastic filled with water, in inverted position, is used to cover the valve. Keep in this position for 12 h. There shall not be any collection of even single bubble by displacement of water on inside the tip of the inverted funnel after a lapse of 12 h.

7.5 Mechanical Resistance (Type Test)

7.5.1 *Impact Resistance Test*

This test is intended to prove the resistance of the extinguisher, and particularly that of the head and fittings, to damage from falling objects or from impact with fixed surfaces.

7.5.1.1 *Requirements*

The extinguisher shall not release pressure in a potentially dangerous manner when tested in accordance with **7.5.1.2**.

The extinguisher shall be judged fit and proper if, during the course of the impact tests, there is no evidence of bursting, breakage or ejection of components that puts the safety of the user at risk.

7.5.1.2 *Test method*

Condition an extinguisher, correctly charged and equipped with all the fittings which are subject to internal pressure in normal operation, for 18 h minimum to the minimum working temperature (*see* **7.1**) with a tolerance of ± 5°C, within 5 min after the removal of the extinguishers from the conditioning chamber, subject it to the impact test describe below.

If the extinguisher is of the gas cartridge type, fit the charged cartridge and activate the extinguisher with the control valve shut, so as to keep the extinguisher under pressure. Conduct the impact test as follows:

Mount a steel cylindrical hammer, of 75 mm diameter and total mass of 4.0 kg with flat faces, vertically in loose guides so that it can drop freely through a height h (minimum height 300 mm) given by:

$$h = \frac{\mathrm{M}}{20}$$

where,

h = height, expressed in m; and

M = total mass of extinguisher expressed, in kg.

The extinguisher shall be placed on a rigid flat surface, protecting pressure gauge, in each of the following two positions in turn:

a) In the normal upright position, with the longitudinal axis of the hammer coincident with the longitudinal axis of the valve; and

b) Lying on its side so that the valve rests on a rigidly fixed steel block.

In each of the above positions, submit the valve of the extinguisher to an impact by allowing the steel hammer to fall freely and vertically onto it from the height h. The point of impact is to be examined.

7.5.2 *Vibration Resistance Test (Type Test)*

7.5.2.1 *Test principle*

An extinguisher shall be capable of withstanding exposure to the conditions of a vibration test without development of physical weakness, which impairs its normal operation.

7.5.2.2 *Extinguisher mounting requirements*

Extinguishers shall be subjected to the test specified in **7.5.2.5.2**.

7.5.2.3 *Test criteria*

The test criteria are as follows:

a) Following exposure to the vibration test, the extinguisher shall comply with the discharge requirements specified in **7.2**; and
b) Physical failure of components which require repair, or replacement of the extinguisher and/or components before it can be returned to normal service shall be cause for rejection.

7.5.2.4 *Mounting of the test specimen*

Mount a fully charged extinguisher in an upright position.

7.5.2.5 *Test method*

7.5.2.5.1 *Axes of orientation*

Subject the extinguisher to the vibration test specified in **7.5.2.5.2** in each of the two rectilinear axes in the following order:

a) Horizontal, and
b) Vertical.

7.5.2.5.2 The vibration applied shall have the following parameters:

Frequency : 40 Hz, *Min*
Amplitude : 0.5 mm, *Min*
Duration : 2 h (in each orientation specified in **7.5.2.5.1**)

7.6 Resistance to Corrosion (Type Test)

7.6.1 *External Corrosion Test for all Types of Extinguishers*

The test salt solution for salt spray be prepared by dissolving 50 ± 5 g of sodium chloride per litre of potable water.

Subject one complete and fully charged extinguisher including their mounting, that is, the test bracket and wall hook, to a salt spray test for a period of 240 h. Following a drying period of at least 24 h at room temperature, carefully wash the extinguisher to remove any salt deposits. Salt spray test apparatus covered in IS 11864, shall be used for salt spray test.

At the conclusion of the test the following requirements shall be satisfied:

a) The mechanical operation of all working parts shall be unimpaired;
b) The minimum effective discharge time and bulk range of discharge shall comply with the requirements specified in **7.2**;
c) The pressure gauge, if one is fitted, shall remain functional and watertight; and
d) There shall be no corrosion of the metal of the extinguisher body; discolouration/superficial corrosion of non-ferrous metals is acceptable, but galvanic corrosion between dissimilar metals shall not be permitted.

7.6.2 *Internal Corrosion Test for Extinguishers Using Water-Based Medium and Clean Agent*

Keep one charged extinguisher at elevated temperature of 60 ± 5°C for 7 days in an oven. After completion of 7 days keep the extinguisher at 27 ± 5°C for 24 h and thereafter discharge the extinguisher and then cut it to examine. There shall be no visible signs of corrosion of the metal or detachment, cracking or bubbling. There shall be no visible change in the colour of extinguishing medium other than that resulting from the thermal cycling in case of water base media only.

7.7 Tapping Test (Type Test) (Powder Extinguishers Only)

7.7.1 *Requirements*

Portable extinguishers shall comply with the following requirements after being subjected to the conditioning specified in **7.7.3**:

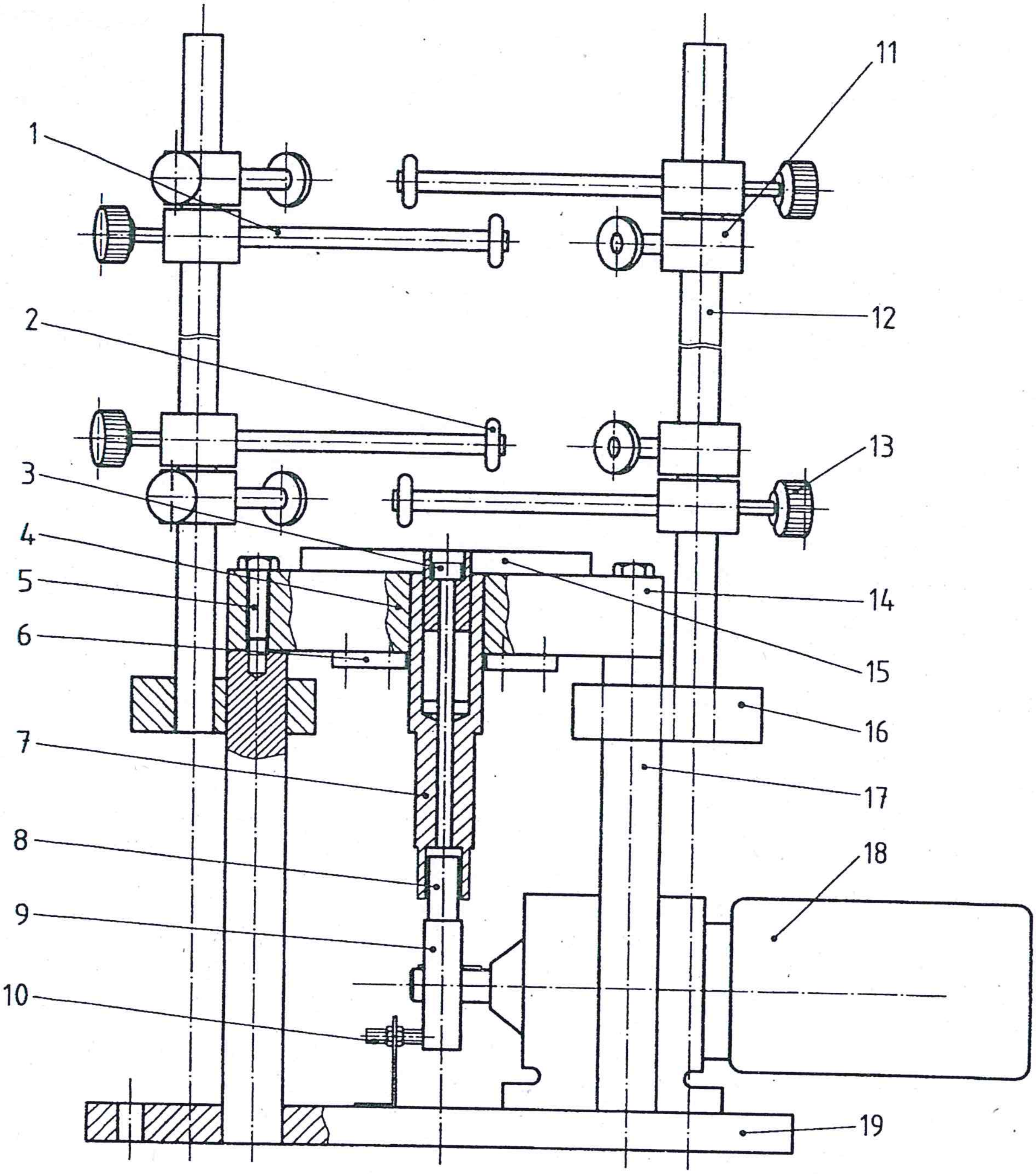
a) Shall operate satisfactorily;
b) Commence discharge within 5 s of the opening of the control valve; and
c) Not retain more than 15 percent of initial charge within the extinguisher following complete discharge.

7.7.2 *Test Apparatus*

7.7.2.1 Compaction machine, designed to accept only one extinguisher at a time which shall be raised by rod and guided by castors**.**

The plate supporting the extinguisher shall be of steel 300 ± 5 mm square and 60 ± 1 mm thick. Figure 1 is an example of an acceptable test apparatus. Observe the following points:

a) Ensure that the rod is adjustable as to adjust to the extinguisher base;
b) Ensure that the rod can move freely in the guide castors;
c) Extinguisher shall also be guided without constraint; and
d) Ensure that the impact shall take place on the still plate but not on the rod.

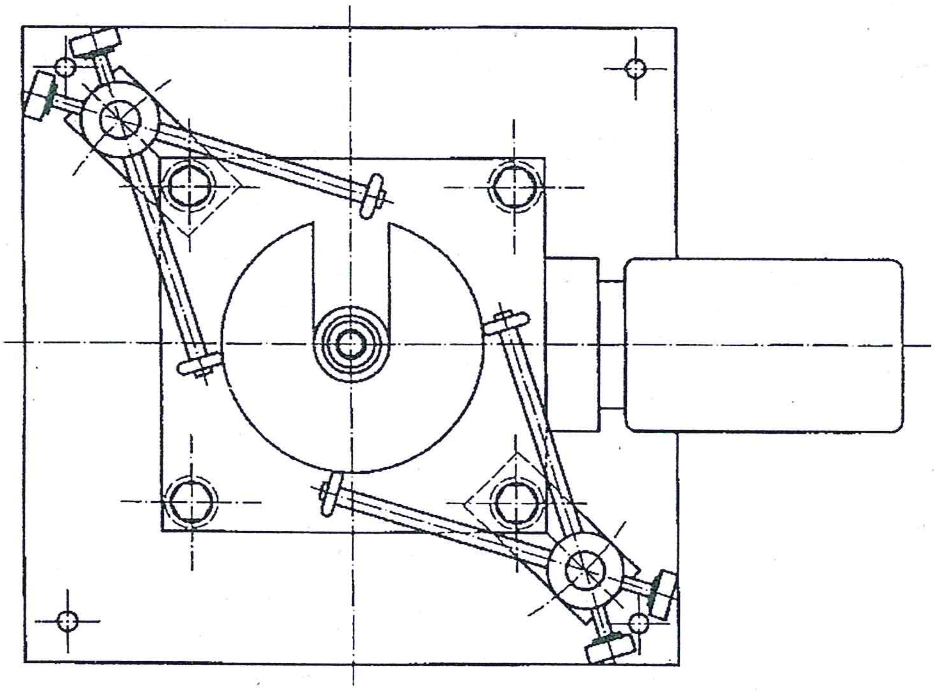


1A GENERAL DIAGRAM

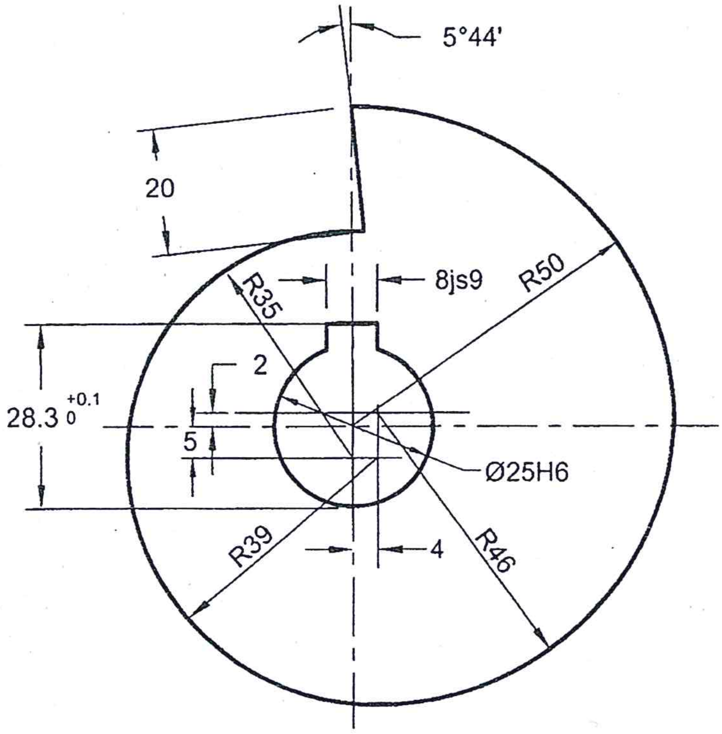
Key

1. Castor support axis
2. Castors
3. Cl + C, M12 – 190 screw
4. Push-nut extinguisher
5. H, M16-90 screw
6. Plates
7. Piston
8. Castor
9. Cam
10. Inductive pick-up
11. Rotation guidance
12. Axes
13. Castor nut
14. Support plate
15. Adjusting block
16. Support axes
17. Plate support axis
18. Flender-Himmel geared motor
19. System support plate

FIG. 1 TAPPING MCHINE — (*Continued*)



1B View from Above



All dimensions in millimetres.

1C Side View

FIG. 1 TAPPING MCHINE

7.7.3 *Test Method*

An extinguisher in a normally charged condition shall be held in the vertical position and dropped vertical 500 times from a height of 15 mm at a frequency of 1 Hz onto a rigid horizontal steel plate.

The extinguisher is to be removed from the test apparatus with a minimum amount of agitation, held in its normal working position, and operated.

NOTE — For cartridge operated extinguishers, pierce the cartridge and allow the pressure to build for 6 s before opening the control valve.

7.8 Intermittent Discharge Test

7.8.1 An extinguisher conditioned at 27 ± 5°C and at 60 ± 5°C shall operate in such a manner that no more than 5 s elapses from the time the control valve is opened until the extinguishing media starts to discharge. Additionally, at the end of discharge, the extinguisher shall not retain more than the following percentages of its original charge:

a) Powder : 15 percent; and
b) All others : 10 percent.

7.8.2 Condition a correctly charged extinguisher at each of the specified temperature for a minimum of 18 h. Operate the extinguisher intermittently by opening and closing the valve in cycles of 2 s ‘open’ and about 2 s ‘closed’ until the end of discharge is reached. The measured retention shall not exceed as mentioned in **7.8.1**.

NOTE — For cartridge operated extinguishers, pierce the cartridge and allow the pressure to build for 6 s before opening the control valve.

8 PERFORMANCE REQUIREMENTS FOR TEST FIRES

8.1 Rating Suitability for the Various Classes of Fire

8.1.1 *Class A*

The rating of extinguishers recommended as suitable for Class A fires shall be determined using the method described in **8.3**. The rating shall be based on the amount of extinguishing medium used to extinguish the fire of maximum size under the conditions of the test. This amount shall not be less than the appropriate minimum value given in Table 3.

8.1.2 *Class B*

The rating of extinguishers recommended as suitable for Class B fires shall be determined using the method given in **8.4**. The rating shall be based on the amount of extinguishing medium used to extinguish the fire of maximum size under the conditions of the test. This amount shall not be less than the appropriate minimum value given in Table 4.

8.1.3 *Class C*

There are no tests requirements for fire performance test of extinguishers against Class C. Suitability for use against Class C fire may be claimed for extinguishers that achieve Class B fire rating.

8.1.4 *Class D*

Extinguishers recommended as suitable for Class D fires shall extinguish the appropriate test fire or fires when tested as described in **8.5**.

NOTE — Extinguishers suitable for Class D fires are usually not suitable for use on fires of other classes. Applicators are typically used in place of nozzles in the extinguishers for fighting Class D fires.

8.1.5 *Class F*

Extinguishers recommended as suitable for Class F fires shall extinguish the appropriate test fires as described in **8.6** and pass the splash test requirements as described in **8.7**. In addition, wet-chemical type extinguishers shall meet the requirements of **8.8**.

Table 3 Minimum Class A Fire Ratings

(*Clause* 8.1.1)

Sl No.	**Extinguishing Medium Content (Charge)**			**Minimum Class A Rating**
	Powder kg	Water/Foam/Water Mist litre	Clean Agent kg	
(1)	(2)	(3)	(4)	(5)
i)	≤ 2	≤ 6	≤ 6	1A
ii)	>2, ≤ 4	> 6, ≤ 10	>6, ≤ 8	2A
iii)	>4, ≤ 6	> 10	>8	3A
iv)	> 6, ≤ 9	–	–	4A
v)	>9	–	–	6A

NOTES

1 BC type of dry powders have no class A rating.

2 The fire rating shall be declared by the manufacturer based on the test report of a recognized laboratory.

Table 4 Minimum Class B Fire Ratings

(*Clause* 8.1.2)

Sl No.	**Extinguishing Medium Content (Charge)**				**Minimum Class B Rating**
	Powder kg	Carbon dioxide kg	Clean Agent kg	Foam/ Water Mist litre	
(1)	(2)	(3)	(4)	(5)	**(6)**
i)	≤ 2	≤ 2	≤ 2	–	21B
ii)	>2, < 3	>2, < 5	>2, ≤ 4	< 3	34B
iii)	≥ 3, ≤ 4	≥ 5	>4, ≤ 6	≥ 3, ≤ 6	55B
iv)	>4, ≤ 6	–	>6	>6, ≤ 9	89B
v)	> 6	–	–	>9	144B

NOTE — The fire rating shall be declared by the manufacturer based on the test report of a recognized laboratory.

8.2 Test Fires — General

8.2.1 *Operators Clothing*

To carry out these tests the operator shall wear suitable protective clothing including shoes, helmet, visor, gloves, etc.

NOTE — Attention is drawn to the necessity for taking precautions to safeguard the health and safety of personnel conducting the tests against the risk of fire and inhalation of smoke and any toxic products of combustion, and compliance with the national legislation which may apply concerning the health and safety of the extinguisher operator and other personnel.

8.2.2 *Requirements for Extinguishment*

Test fires shall be regarded as extinguished if:

a) *Class A* − All flames are extinguished. There shall be no flames visible 3 min after complete discharge of the extinguisher. The appearance of non-persistent flames during the 3 min period shall be ignored. Non-persistent flames are defined as less than 50 mm in height and less than 1 min duration; if the class A crib collapses during the test, it shall be considered void and a fresh test carried out**.**

b) *Class B* − All flames are extinguished.

c) *Class F* − All flames are extinguished. There shall be no re-ignition of the vegetable oil for 3 min after discharge.

8.2.3 *Test Extinguishers and Method of Use*

Use extinguishers filled and charged according to the manufacturer's instructions. For cartridge-operated extinguishers, pierce the cartridge and allow the pressure to build for 6 s before opening the control valve.

8.2.4 *Test Schedule (Type)*

The basic schedule of testing is one fire test. However one repeat test is allowed if 1st test is failed and no further test is required if repeat test is passed.

8.3 Class A Test Fire

8.3.1 *Location*

Conduct the tests in an essentially draught-free room having adequate volume and ventilation to ensure the necessary supply of oxygen and reasonable visibility for the period of the test.

Air inlet openings at or near ground level as given in Table 5, with a flue area of 4.5 m^2 have been found to provide adequate ventilation. Or in a suitable open space separate from other activities having sufficient precaution to control fire as an accidental measure and in the limit of wind velocity and temperature (controlled environmental condition) may be suitable for use for any type of fire test.

NOTES

1 For example, it has been established that a room having a ceiling height of approximately 3 m and size 7 m × 7 m for class up to 2A and 34 B and of size 15 m × 15 m for higher classes with adjustable inlet openings near the four corners is suitable for these purposes. The room should have smoothly finished concrete floor.

2 This test may be carried out by putting 3 m high mild steel sheet enclosing three sides till infrastructure is developed for indoor test facilities.

8.3.2 *Construction*

The test fire consists of a crib made of pieces of wood. The pieces of wood forming the outside edges of the crib may be stapled or nailed together to provide enough strength.

Table 5 Example of Typical Air Inlet Sizes for Ventilation of Class A Test Fires

(*Clause* 8.3.1)

Sl No.	Classification and Rating	Minimum Air Inlet Opening Surface Area m^2
(1)	(2)	(3)
i)	1A	0.10
ii)	2A	0.10
iii)	3A	0.15
iv)	4A	0.20
v)	6A	0.30
vi)	10A	0.50
vii)	15A	0.75
viii)	20A	1.00

Construct the crib on two 63 mm × 38 mm angle irons or other similar and appropriate supports, placed on concrete blocks or support frame so as the height of the supports above the floor is 400 ± 10 mm.

Stack the pieces of wood in the appropriate arrangement specified in Table 6. Stack each layer of the pieces of wood at right angles to the layer below. Stack individual pieces of wood on each layer with even spacing and in the form of a square with sides equal to the length of the piece of wood (*see* Fig. 2).

Use pieces of wood of Pinus sylvestris, (Indian name *Kail*) or any other wood which can be shown to be equivalent, of appropriate length as specified in Table 6 and of square cross-section with sides of 37 ± 1 mm, a moisture content of 10 percent to 14 percent by mass (dry basis).

NOTES

1 Wood is considered to be equivalent if the rating achieved using wood that is not more than that achieved when Pinus sylvestris is used. Cryptomeria japonica may be preferred in India.

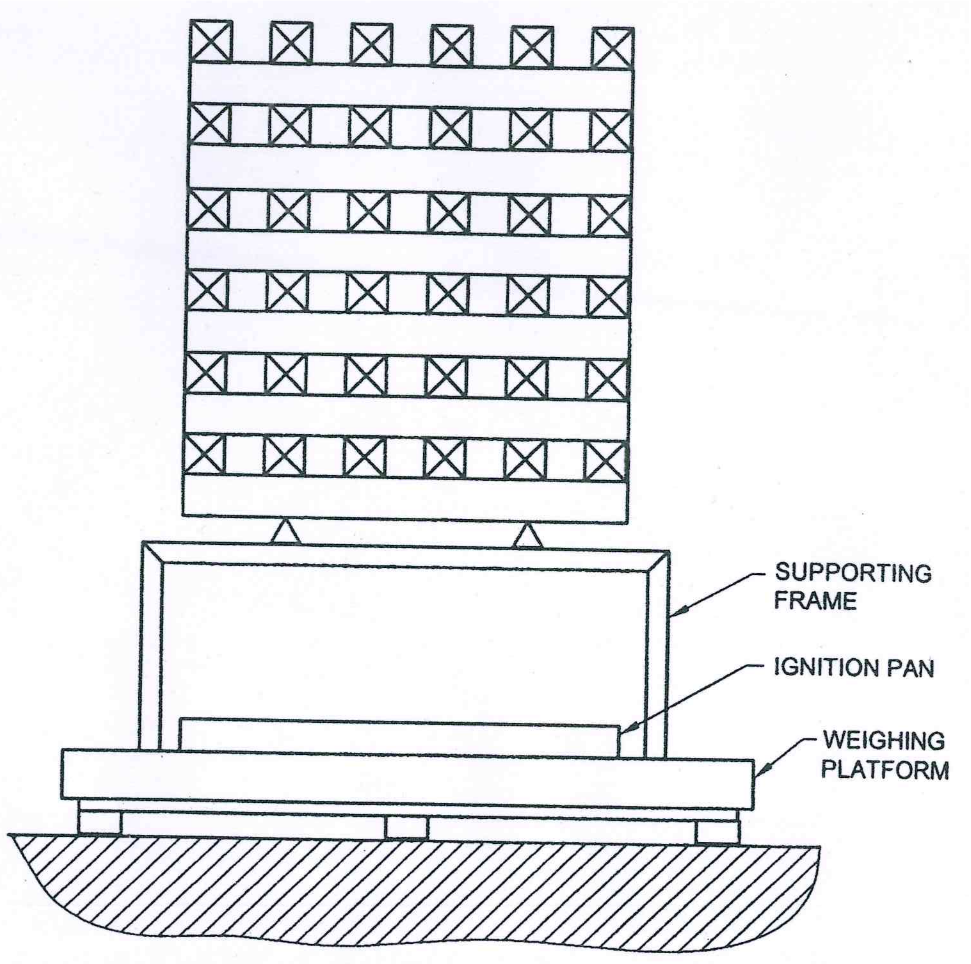


FIG. 2 CRIB FIRE

Table 6 Wood Crib Construction

(*Clause* 8.3.2)

Sl No.	Class A Rating	Number of Pieces of Wood	Length of Pieces of Wood mm	Arrangement of Pieces of Wood
(1)	(2)	(3)	(4)	(5)
i)	1A	72	500	12 layers of 6 pieces of wood
ii)	2A	112	635	16 layers of 7 pieces of wood
iii)	3A	144	735	18 layers of 8 pieces of wood
iv)	4A	180	800	20 layers of 9 pieces of wood
v)	6A	230	925	23 layers of 10 pieces of wood
vi)	10A	324	1 100	27 layers of 12 pieces of wood
vii)	15A	450	1 190	30 layers of 15 pieces of wood
viii)	20A	561	1 270	33 layers of 17 pieces of wood

NOTE — If necessary in the future, it is intended that this table be extended to include larger test fires. These will be constructed on the same principles as those now listed. Each Class A rating is designated by a number in a series which is proportional to the mass of wood contained in a crib. All cribs are cubic with the volume of the open space approximately equal to the volume of the wood.

2 Determine the moisture content of the pieces of wood using commercially available instruments which measure electrical conductivity between needle probes pushed into the sticks or other suitable method. Some variation in reading may be obtained due to structural variation of the timber and the direction of the grain. Calibrate the instrument by determination of moisture content in accordance with IS 1708 (Part 1).

8.3.3 *Procedure*

Place an ignition pan of appropriate size as specified in Table 7 on the floor under the crib. Level the pan as far as possible and add sufficient water to cover the base. Pour the appropriate volume of fuel (as specified in Table 7) into the pan. Ignite the fuel. Remove the pan once the liquid has been consumed.

Table 7 Wood-Crib Ignition Arrangement

(*Clause* 8.3.3)

Sl No.	Class A Rating	Ignition Pan Size mm	Heptane Charge *l*
(1)	(2)	(3)	(4)
i)	1A	400 × 400 × 100	1.1
ii)	2A	535 × 535 × 100	2.0
iii)	3A	635 × 635 × 100	2.8
iv)	4A	700 × 700 × 100	3.4
v)	6A	825 × 825 × 100	4.8
vi)	10A	1 000 × 1 000 × 100	7.0
vii)	15A	1 090 × 1 090 × 100	7.6
viii)	20A	1 170 × 1 170 × 100	8.2

Allow the crib to burn until its mass is reduced to 55 ± 2 percent of its original mass. The mass loss may be determined directly by weight (placing the wood crib on the MS stand and fire tray on the weighing scale) and or by other methods which can be demonstrated to provide equivalent correlation.

NOTE — This will take 6 min to 10 min. Either monitor the mass continuously or determine the time by a preliminary test or tests, extinguishing the fire(s) and measuring the mass and core diameters making adjustments as necessary.

Apply the discharge of the extinguisher to the test fire, initially to the front. Reduce the distance of attack and apply the discharge to the top, bottom, front or either side at the decision of the operator. Maintain all devices for controlling the flow of the extinguishing media in the position for maximum discharge.

8.4 Class B Test Fire

8.4.1 *Location*

Carry out fire test at indoor or environmental controlled open space having the wind speed not exceeding 3 m/s. Do not carry out tests outdoors when rain, snow or hail is falling.

8.4.2 *Construction*

Class B test fires utilize a range of welded-sheet-steel cylindrical trays (dimensions given in Table 8). The sides are vertical. The base of the trays are set horizontal and level with the surrounding ground.

NOTE — Reinforcement of the base of the larger test fire trays will be necessary to minimize distortion. In such cases it will be necessary to ensure that the underside of the trays are not exposed to the atmosphere.

Details of Class B test fires are given in Table 8. Each test fire is designated by a number followed by the letter B.

8.4.3 *Fuel*

Use commercial grade n-heptane having an initial boiling point of not less than 88°C and a final boiling point of not more than 105°C.

8.4.4 *Procedure*

8.4.4.1 Add the appropriate volume of water and heptane specified in Table 8. Add additional water to compensate for distortion of the base so that all points are covered, subject to a maximum liquid depth of 50 mm.

8.4.4.2 For the testing of foam extinguishers use fresh fuel for each test.

8.4.4.3 When testing powder type extinguishers it shall be demonstrable that the rating can be achieved using fresh fuel.

8.4.4.4 Ignite the fuel.

8.4.4.5 Permit the fuel to burn freely for a period of 60 ± 5 s before operating the extinguisher.

8.4.4.6 Operate the extinguisher and apply the extinguishing medium to the test fire.

NOTES

1 The extinguisher may be discharged continuously or in intermittent bursts at the discretion of the operator. The operator may move round the fire in order to obtain the best results.

2 For reasons of safety the operator shall not reach step over the edge of the tray, and at no time shall the operator step onto or into the tray.

8.5 Class D Test Fire

8.5.1 *General*

The extinguishment of these test fires is based on the use of a portable extinguisher having a nominal charge 10 kg of media. Extinguishers having a lesser charge shall be tested using a proportionally reduced quantity and surface area of fuels. Extinguishers with a charge of less than 9 kg shall not be allowed.

Table 8 Dimensions of Class B Test Fires

(*Clause* 8.4.2)

Sl No.	Class B Rating	Minimum Discharge of Extinguisher	Volume of Liquid[1]	Dimensions of Test Fire Tray			
				Diameter[2]	Internal Depth[3]	Minimal Thickness of Walls	Approximate Surface Area of Fire
		s		mm	mm	mm	m^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	8B[3]	-	8	570 ± 10	150 ± 5	2.0	0.25
ii)	13B[3]	-	13	720 ± 10	150 ± 5	2.0	0.41
iii)	21B	8	21	920 ± 10	150 ± 5	2.0	0.66
iv)	34B	8	34	1 170 ± 10	150 ± 5	2.5	1.07
v)	55B	9	55	1 480 ± 15	150 ± 5	2.5	1.73
vi)	(70B)	9	70	(1 670 ± 15)	(150 ± 5)	(2.5)	(2.20)
vii)	89B	9	89	1 890 ± 20	200 ± 5	2.5	2.80
viii)	(113B)	12	113	(2 130 ± 20)	(200 ± 5)	(2.5)	(3.55)
ix)	144B	15	144	2 400 ± 25	200 ± 5	2.5	4.52
x)	(183B)	15	183	(2 710 ± 25)	(200 ± 5)	(2.5)	(5.75)
xi)	233B	15	233	3 000 ± 30	200 ± 5	2.5	7.32

NOTE — Each test fire is designated by a number in a series in which each term is equal to the sum of the two preceding terms (this series is equivalent to geometric progression having a common ratio of about 1.62). Test fires larger than those given may be constructed following the rules of this geometric progression. The additional fires 70B/113B/183B represent the product of the preceding term and $\sqrt{1.62}$.

[1] One-third water and two-third n-heptane.

[2] Measured at rim.

[3] This fire size is for a low-temperature fire test only.

> **WARNING** — Some extinguishing media used for Class D fires are toxic (for example, barium chloride $BaCl_2$) and/or may react with the burning metal to produce materials which are toxic or otherwise hazardous (for example, phosphates which react to form metal phosphides, which are decomposed by water to produce phosphine, PH_3, a spontaneously flammable gas).

Before carrying out these tests, establish procedures to protect personnel and to safely dispose of residues from test fires.

Conduct the tests in an essentially draught-free room having adequate volume and ventilation to ensure the necessary visibility for the period of the test.

There are no numerical components for Class D ratings. The type of combustible metal for which the extinguisher is applicable and the area, depth, and other characteristics of the fires which may be controlled and extinguished are to be summarized on the extinguisher nameplate and described in the manufacturer's installation instructions.

8.5.2 *Metal Chip or Turning Fires*

8.5.2.1 *Construction*

The fires consist of a bed of the metal fuel 600 mm × 600 mm square positioned centrally on a steel base-plate 1 m × 1 m square and 5 mm thick. Use a removable metal or wood frame (600 mm × 600 mm × 300 mm) to build the bed.

For ignition, use a device such as a gas/oxygen torch which will ignite the metal within 30 s.

8.5.2.2 *Fuel*

Carry out the test using 16.2 ± 0.1 kg of reagent-grade magnesium swarf or turning coated with 1.8 ± 0.1 kg petroleum based cutting oil.

8.5.2.3 *Procedure*

For each test, prepare the fuel bed in the removable metal or wood frame. Level the surface of the fuel using a rake or straight-edged board. Remove the frame.

Apply the igniting torch to the centre of the fuel bed, removing the torch after 25 s to 30 s.

Allow the fire to spread until it is estimated that either 25 percent of the fuel is burning or the fire covers 50 percent of the fuel bed surface, whichever occurs sooner. The extinguisher may then be discharged onto the fire at the operator's discretion, continuously or intermittently, according to the manufacturer's instructions. Check that fuel is not scattered off the base plate during the attack.

After discharge is completed, allow the fire bed to remain undisturbed for the period of time recommended by the extinguisher manufacturer, or if no time is recommended, for 60 min. Examine the fuel bed and check that the fire is completely extinguished and that more than 10 percent of the original metal fuel remains.

8.6 Class F Test Fire

8.6.1 *Location*

Carry out test fires indoors in a draft-free room having dimensions of least 6 m × 6 m × 4 m high and at an ambient temperature of between 10 °C and 30 °C.

8.6.2 *Construction*

Details of Class F fire test apparatus are given in Fig. 3 and Fig. 4.

Class F fires utilize a range of welded sheet metal trays (dimensions are given in Figs. 3 and 4). The sides are vertical. The base of the tray is horizontal and level with the surrounding ground or floor.

Each test fire is designated by a number followed by the letter 'F'.

8.6.3 *Fuel*

Class F fires shall be conducted using a vegetable oil having an auto-ignition temperature of not less than 360 °C.

8.6.4 *Procedure*

8.6.4.1 Carry out the fire test at indoor. Heat the oil in the test tray using a suitable heating arrangement. Measure the oil temperature at a point 25 mm below the fuel surface and at least 75 mm away from the walls of the tray.

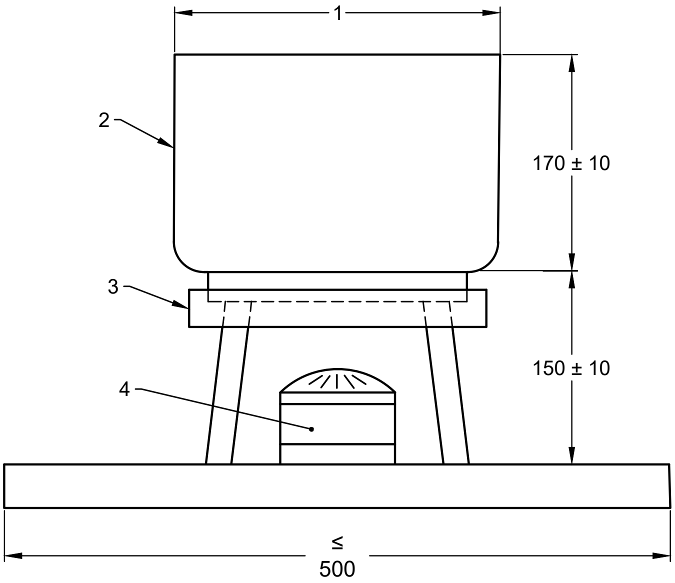
8.6.4.2 Heat the tray, uncovered from the suitable heating source until auto-ignition occurs.

8.6.4.3 At auto-ignition, allow the fire to burn freely for 2 min. Turn off the energy source at auto-ignition. After the 2 min pre-burn, discharge the extinguisher onto the tray continuously or intermittent until the extinguisher is fully discharged. The discharge of the extinguisher onto the tray shall be at distance specified on the extinguisher marking, but shall in no case be less than 1m between the nozzle and the tray.

8.7 Class F Splash Test

8.7.1 *Location*

Carry out test fires indoors in a draft-free room having dimensions of at least 6 m × 6 m × 4 m high and at an ambient temperature of between 10 °C and 30 °C.

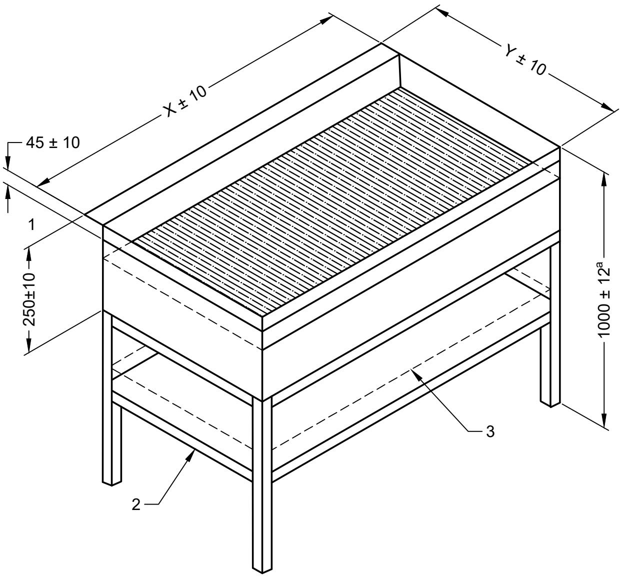


KEY

1 PAN DIAMETER
2 NOMINAL WALL THICKNESS, 2mm
3 SKIRT TO SUIT BURNER TYPE
4 BURNER

All dimensions are in millimeters

FIG. 3 GENERAL DIMENSIONS FOR CLASS F TEST APPARATUS — TYPE A APPARATUS FOR CLASS 5F ONLY



KEY
1 TOP EDGE
2 TRAY TO SUPPORT GAS BURNERS (ALTERNATIVELY, ELECTRICAL HEATING MAY BE USED)
3 SKIRT TO CONTAIN FLAMES FOR GAS HEATING (TO PREVENT PILOTED IGNITION).
a TO FLOOR LEVEL

FIG. 4 GENERAL DIMENSIONS FOR CLASS F TEST APPARATUS — TYPE B APPARATUS FOR CLASSES 15F, 25F AND 75 F

8.7.2 *Construction*

Details of Class F fire test apparatus are given in Table 9 and Fig. 3 and Fig. 4. *See* Fig. 5 for an example of a splash test apparatus.

Class F test fires utilize a range of welded sheet-metal trays (dimensions are given in Table 9 and Fig. 3 and Fig. 4). The sides are vertical. The base of the tray is horizontal.

Each test fire is designated by a number followed by the letter 'F'.

Table 9 Fire Rating of Class F Fires

(*Clause* 8.7.2)

Sl No.	Rating	Volume of Cooking Oil in Test Fire *litre*	Test Apparatus
(1)	(2)	(3)	(4)
i)	5F (Minimum requirement)	5^{+1}_{-0}	Type A Diameter = 300 mm
ii)	15F	15^{+1}_{-0}	Type B X = 448 mm Y = 224 mm
iii)	25F	25^{+1}_{-0}	Type B X = 578 mm Y = 289 mm
iv)	75F	75^{+1}_{-0}	Type B X = 1 000 mm Y = 500 mm

NOTE — Type A is cylindrical apparatus and Type B is rectangular apparatus.

8.7.3 *Fuel*

Class F splash test fires shall be conducted using a vegetable oil having an auto-ignition temperature of not less than 360 °C.

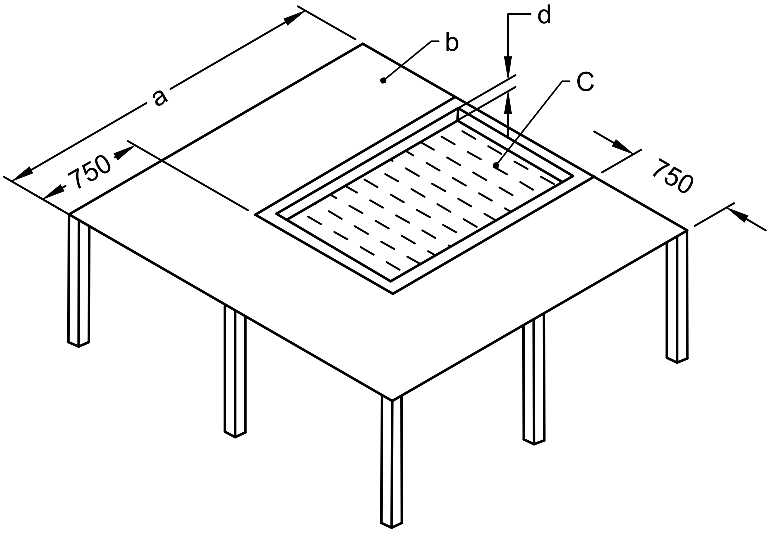
8.7.4 *Procedure*

Use fresh fuel for each test.

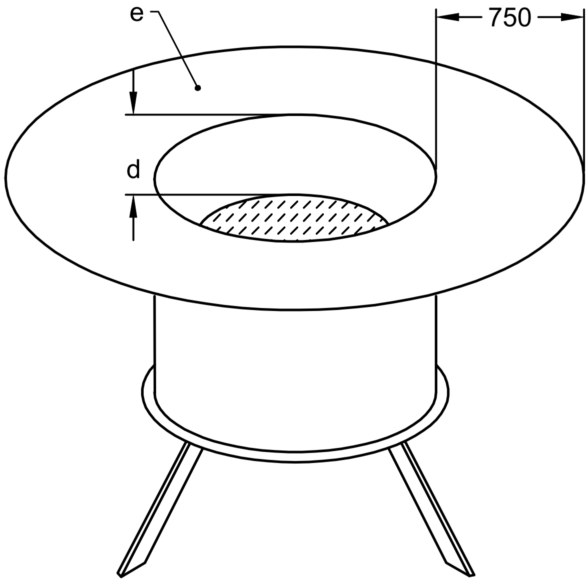
8.7.4.1 Two tests shall be carried out with the extinguisher conditioned as follows:

a) Test 1 — Condition for at least 18 h at the maximum operating temperature; and
b) Test 2 — Condition for at least 18 h at the minimum operating temperature.

8.7.4.2 Place a flat surface completely around the fire tray. The flat surface shall be 750 mm wide and positioned at the top edge of the fire tray. The flat shall be covered with a layer of sodium bicarbonate powder not more than 2 mm deep. Heat the oil in the fire tray using its heat source until a temperature of 175°C to 190°C is achieved. Discharge each conditioned extinguisher fully and continuously towards the centre of the fire tray within 5 min of being conditioned, with the nozzle held at a distance specified by the manufacture and shown on the nameplate of the extinguisher, but not greater than 2 m. Measure the distance from the front edge of the fire tray to the nozzle.



5A CLASSES 15F, 25F AND 75F



5B CLASS 5F

a LENGTH OF TRAY PLUS 1.5 m.
b LAYER OF SODIUM BICARBONATE 2mm DEEP ON TABLE TOP SURFACE.
c TEST TRAY.
d FREE BOARD AT 175°C TO 195°C
e 2mm LAYER OF SODIUM BICARBONATE.

All dimensions are in millimetres

FIG. 5 SPLASH TEST APPARATUS

8.7.5 *Requirements*

The discharge from the extinguishers when tested in accordance with **8.7.1** to **8.7.4** shall not splash grease droplets in excess of 5 mm diameter.

8.8 Electrical Conductivity of Extinguisher Discharge (Type Test)

8.8.1 Water based, foam based and water mist type extinguishers that are marked as suitable for use on energized electrical equipment fires and shall not pass a current of more than 0.5 mA, when tested as described in **8.8.3.** These extinguishers, if used with and anti-freeze agent should be treated as separate and distinguished models for the electrical conductivity test.

8.8.2 *Requirements*

Test the extinguisher in accordance with **8.8.3**. When the extinguisher is in operation and the metallic plate is live, the current between the handle or the nozzle and earth and between earth and the extinguisher shall be no more than 0.5 mA at any time during the complete discharge duration of the extinguisher.

8.8.3 *Test for Electrical Conductivity*

Hang a metal plate, of dimensions 1 m ± 25 mm × 1 m ± 25 mm, vertically from insulating supports. Connect the plate to a transformer so that an alternating voltage of 36 ± 3.6 kV is established between the plate and earth. The impedance of the circuit should be such that when a voltage equal to 10 percent of the normal primary voltage is applied to the primary, and the secondary is short-circuited, the current in the secondary is not less than 0.1 mA.

Mount the extinguisher on an insulating support with the nozzle fixed 1 m from the centre of the plate, at right angles to it and directed towards it. Connect the extinguisher to the earth. In the case of an extinguisher with a hose connect it to the earth by connection at the nozzle or in the case of an extinguisher not fitted with a hose, by connection at the handle.

Measure any current flowing between the extinguisher and the earth when the plate is live and the extinguisher discharging.

9 CONSTRUCTION REQUIREMENTS

9.1 High-Pressure Extinguishers

Extinguishers with a service pressure greater than 19 bar (for example, carbon dioxide type) shall have concave base. For carbon dioxide type extinguishers, in case of steel body, it shall conform to IS 7285 (Parts 1 and 2) and in case of aluminium-body, it shall conform to IS 15660. Gas cartridge shall conform to IS 4947.

9.2 Low-Pressure Extinguishers

9.2.1 *General Requirements*

9.2.1.1 These requirements are applicable to extinguishers having a service pressure (P_s) not exceeding 19 bar.

9.2.1.2 A portable extinguisher with a charge exceeding 3 kg shall be constructed such that it can be stood vertically without extra support. Gas cartridge shall conform to IS 4947.

9.2.1.3 The manufacturer shall ensure that the welds show continuous penetration with no deviation in the weld. Welds and brazed joints shall be free from defects which are prejudicial to the safe use of the cylinder.

9.2.1.4 Parts attached to the body of the extinguisher shall be manufactured and fitted in a way that minimize concentrations of stress and corrosion risks. In the case of welded and brazed parts, the metal shall be compatible with the cylinder material.

9.2.1.5 The cylinder manufacturer shall obtain the certificate for the cast analysis of material supplied.

9.2.1.6 Where plastic components are threaded into metallic parts they shall be designed to minimize the possibility of cross-threading. This shall be accomplished by the use of coarse threads of less than 5 threads/cm or by the use of square-cut threads.

9.2.1.7 Extinguishers that are free standing shall either be fitted with a means to raise the pressure-retaining part of the body at least 5 mm above the floor, or the thickness of metal in the lowest pressure retaining part or parts of the body shall not be less than 1.5 times the minimum thickness of the cylindrical part of the body.

9.2.1.8 *Determination of maximum service pressure (P_{ms})*

9.2.1.8.1 Conduct the test on one extinguisher conditioned at 60 ± 5 °C for 18 h.

9.2.1.8.2 For stored-pressure type extinguishers, determine the pressure immediately after taking each extinguisher out of the oven. For cartridge-operated type extinguishers, remove each extinguisher from the oven and activate the cartridge immediately.

9.2.1.8.3 For each type of extinguisher the highest pressure observed during **9.2.1.8.2** is recorded as the maximum service pressure (P_{ms}).

9.2.2 *Burst Test*

9.2.2.1 Fill the extinguisher with a suitable liquid and increase the pressure slowly preferably at a rate not exceeding (20 ± 2) bar/min until the minimum burst pressure (P_b) is achieved. Maintain this pressure for

1 min without the cylinder rupturing. Increase the pressure until rupture occurs. The minimum burst pressure (P_b) shall be 2.7 × P_{ms} but in no case less than 55 bar.

9.2.2.2 The bursting test shall not cause the cylinder to fragment.

9.2.2.3 The break shall not show any sign of brittleness, that is the edges of the break shall not be radial but shall be slanting in respect of a diametrical plane and shall exhibit a reduction in area over their entire thickness**.**

9.2.2.4 The break shall not show any characterized defect in the metal.

9.2.2.5 The break shall not occur in the weld at a pressure less than 5.4 × P_{ms} or 8 MPa (80 bar), whichever is greater. Furthermore, the break shall not occur in any permanent body marking, such as a stamping or engraving.

9.2.2.6 During the burst test, no parts shall be ejected from the extinguisher**.**

9.2.3 *Crushing Test (Type Test)*

9.2.3.1 Crush one extinguisher perpendicularly to its longitudinal axis, and at its midpoint using two 25 mm thick mandrels with a radius at their apex of 12.5 mm and a width sufficient to extend beyond the sides of the extinguisher (*see* Fig. 6). Crush the cylinder till the outer diameter reduces to one-third of the original outer diameter. In the case of extinguishers with a longitudinal weld place, the weld seam at 90° to the support lines. For extinguishers with central transverse welds, apply the mandrel at 45° to the weld seam.

9.2.3.2 After the crushing test, fill the extinguishers with water and increase the pressure to test pressure (P_t). The extinguishers shall not exhibit any cracks or leaks.

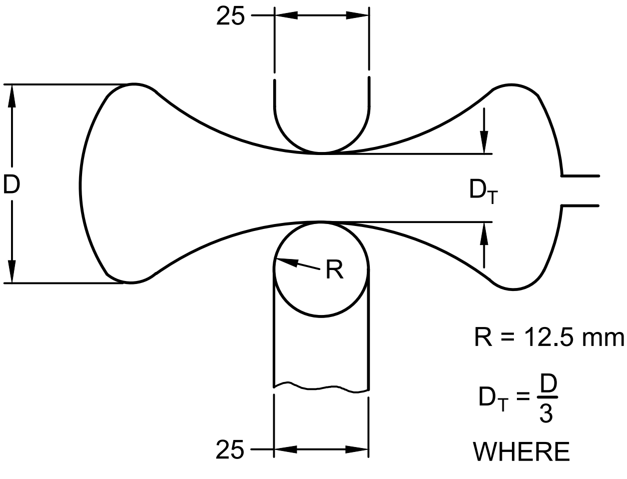
9.2.4 *Pressure Cycling Test (Type Test)*

A minimum of one cylinder shall be tested. An extinguisher cylinder shall sustain, without rupture, 5 000 cycles from 0 to the test pressure (P_t) and back to 0 at the rate of 6 cycles/min. At the conclusion of testing, the cylinder shall be subjected to and comply with the burst test.

9.2.5 *Welded Low Carbon Steel Cylinder*

9.2.5.1 The cylinder material shall be capable of being welded and shall contain a maximum of 0.25 percent carbon, 0.05 percent of sulphur and 0.05 percent of phosphorous.

9.2.5.2 Filler material shall be compatible with the steel to give welds with properties equivalent to those specified for the base sheet.



R = 12.5 mm

$D_T = \frac{D}{3}$

WHERE

D_T IS THE DISTANCE AFTER TEST

D IS THE OUTSIDE DIAMETER OF CYLINDER

All dimensions are in millimeters

FIG. 6 CRUSHING TEST

9.2.5.3 The cylinder shall have a measured wall thickness greater than the minimum wall thickness given by the following formula but in no case less than 0.70 mm:

$$S = \frac{D}{300} + k$$

where

S = minimum wall thickness, expressed in mm;

D = outside diameter of the cylinder or, for non-cylindrical bodies, the greatest external diagonal of the extinguisher body, expressed in mm; and

k = coefficient equal to:

0.45 for $D \leq 80$;

0.50 for $80 < D \leq 100$; and

0.70 for $D > 100$.

9.2.6 *Stainless Steel Cylinders*

9.2.6.1 Stainless steel domes and bottoms shall be drawn from fully annealed stock.

9.2.6.2 Only austenitic stainless steel having a maximum carbon content of 0.03 percent shall be used.

9.2.6.3 The cylinder shall have a minimum measured wall thickness greater than the minimum wall thickness given by the following formula but in no case less than 0.64 mm:

$$S = \frac{D}{600} + k$$

where

S = minimum wall thickness, expressed in mm;

D = outside diameter of the cylinder or, for non-cylindrical bodies, the greatest external diagonal of the extinguisher body, expressed in mm; and

k = 0.3.

9.2.7 *Aluminium Cylinders*

9.2.7.1 Aluminium cylinders shall be of a seamless construction.

9.2.7.2 Aluminium cylinders shall have a measured wall thickness greater than or equal to the minimum thickness given by the following formula but in no case less than 0.71 mm:

$$S = \frac{D}{80} + k$$

where

S = minimum wall thickness, expressed in mm;

D = outside diameter of the cylinder, or for non-cylindrical bodies the greatest external diagonal of the extinguisher body, expressed in mm; and

k = coefficient equal to:

0.2 for $D \leq 100$ mm;

0.3 for $D > 100$ mm.

9.2.8 *Composite Cylinders*

9.2.8.1 The cylinder shall be made of resin impregnated or non impregnated continuous fibres filament wound over a non-metallic liner. The cylinder shall conform to accelerated stress rupture test as given in **9.2.8.4**

9.2.8.2 The structural reinforced filament material shall be aramid fibre and the impregnation material may be thermosetting or thermoplastic resin. Examples of suitable resin are epoxy, modified epoxy, polyester and vinylester thermosetting plastics, and polyethylene and polyamide thermoplastic material.

9.2.8.3 The liner shall be polymeric material.

9.2.8.4 *Accelerated stress rupture test*

One fire extinguisher shall be hydrostatically pressurized to 1.5 times the service pressure at 60 ± 5 °C. The extinguisher shall be held at this pressure and temperature for 1 000 h. The extinguisher shall then be tested for burst test in accordance with **9.2.2** and shall meet the requirements therein.

9.3 Carrying Handle

9.3.1 An extinguisher having a total mass of 1.5 kg or more and having a cylinder diameter of 75 mm or more shall have a carrying handle.

NOTE — The valve assembly head itself may be considered a handle, provided it meets the requirements of **9.3.2** and **9.3.3**.

9.3.2 The carrying handle shall not be less than 90 mm long for an extinguisher of 7.0 kg or more total mass and shall not be less than 75 mm long for an extinguisher of less than 7.0 kg total mass.

9.3.3 There shall not be less than 25 mm clearance between extinguisher body and the carrying handle when the handle is in the carrying position.

9.4 Mounting

9.4.1 Each extinguisher intended for wall mounting shall be provided with a means of mounting.

9.4.2 A wall mounting hook shall require both horizontal and vertical motion of minimum 6 mm to remove the extinguisher from the wall.

9.4.3 A mounting bracket shall be capable of withstanding a static load of five times the fully charged mass of the extinguisher, when tested in accordance with **9.4.4**.

9.4.4 Place an extinguisher charged to its rated capacity in the mounting bracket provided with the extinguisher after the mounting bracket has been secured to a wooden board. Secure the board in a vertical position and apply a static load of four times the full extinguisher mass (or a total load of 45 kg minus the full extinguisher mass, minimum) to the top of the extinguisher. Hold the load for 5 min.

9.4.5 A mounting bracket equipped with a strap shall not permit the extinguisher to drop to the floor when the strap clamp is opened. The clamp releasing device shall be of a colour contrasting with that of the immediate extinguisher background and shall be visible. The method of release shall be obvious when viewing the front of the extinguisher.

9.4.6 A hanger loop shall be located so that the operating instructions face outward when the extinguisher is supported by the mounting means.

9.5 Caps, Valves and Closures

9.5.1 Cylinder caps, valves and closures shall be designed to provide release of pressure before complete disengagement.

9.5.2 Threaded connections on cylinder shall have at least four full threads of engagement and be required to relieve pressure with at least two full threads of engagement. Other types of valves, caps and closures are permissible if they can satisfy the same requirements, particularly with regard to recurrent tests and filling.

9.5.3 The inside diameter of a filling opening for a rechargeable type extinguisher shall be no less than 19 mm except for carbon dioxide (CO_2) and other gaseous agents extinguishers.

9.5.4 An extinguisher collar or neck ring with external threads shall have sufficient height so that the cap or valve does not contact the dome or bottom with the gasket removed.

9.5.5 A cap, valves or closure shall withstand the burst test pressure specified for the cylinder for 1 min without rupture. For this test, remove or plug pressure relief devices.

9.5.6 The edges and surfaces of a fire extinguisher and its mounting bracket shall not be sufficiently sharp to constitute a risk of injury to persons during intended use or while performing maintenance.

9.6 Safety Devices

9.6.1 High pressure cylinders and cartridges shall be provided with a safety device in accordance with national regulations.

9.6.2 There are no compulsory safety systems required for low-pressure extinguishers. However, if such a system is used, it must be appropriately sized and positioned. The operating pressure of the device shall not exceed the test pressure (P_t) nor be less than the maximum service pressure (P_{ms}).

9.7 Requirements for Plastics Components

Plastics components used in portable fire extinguishers shall comply with the requirements given in **9.7.1** to **9.7.3**.

NOTE — Alternatively, for plastic components, test certificate of manufacturer of plastic components or BIS licensees or any other recognized test laboratory shall be acceptable and no test is required for acceptance criteria except the test for exposure to extinguishing medium (*See* **9.7.3**).

9.7.1 *Air-Oven Ageing*

9.7.1.1 Subject at least two components to accelerated ageing in an oven at 100 °C for 10 days.

9.7.1.2 Following the exposure, condition the components for 5 h at 27 ± 5 °C and subsequently inspect them for cracking or brittleness. No cracking or brittleness shall be permitted.

9.7.2 *Impact Resistance*

9.7.2.1 Mount at least four samples subjected to the ageing test (*see* **9.7.1**) (two with and two without the safety locking device engaged), and pressurize the extinguisher cylinder to the maximum service pressure (P_{ms}) with nitrogen after being filled 95 percent with a water and anti-freeze solution. Test the samples at 27 ± 5 °C or at the minimum recommended operation temperature, whichever is lower. The test is carried out as described in **7.5.1**.

9.7.2.2 No hazardous changes shall occur to the valve assembly such as splinters, fractures or cracks. The valve shall then be capable of withstanding the test pressure (P_t) without bursting.

9.7.3 *Test for Exposure to Extinguishing Medium*

9.7.3.1 Immerse complete plastic parts in the extinguishing (water based only) media with which they are to be used. Place the container of media, with the samples in place of preheated oven at 90 ± 5 °C for 10 days. After the test exposure, cool the samples in air at 27 ± 5 °C for at least 24 h and then observe the cracking or brittleness.

9.7.3.2 Following the exposure, inspect the component for cracking or brittleness. No cracking or brittleness shall be permitted.

9.8 Hose Assemblies

9.8.1 Extinguishers having a mass of extinguishing medium greater than 3 kg, or a volume of extinguishing medium greater than 3 litre shall be provided with a flexible discharge hose.

The length of the flexible section of the hose assembly shall be 400 mm or greater.

9.8.2 The hose and coupling or crimping system shall function throughout the operating temperature range, and coupling systems shall be designed and fitted in such a way that they cannot damage the hose.

9.8.3 The burst pressure of a hose assembly fitted with a shut-off nozzle shall be equal to or greater than appropriate value below. The test pressure shall be established by increasing the pressure to the minimum allowable burst pressure in a time no less than 30 s, maintaining that pressure for 30 s during which failure shall not occur and then increasing the pressure until failure occurs.

For all types except carbon dioxide (CO_2) type extinguishers:

a) 2.0 times the maximum service pressure (P_{ms}), the test being carried out at 27 ± 5 °C; and
b) 1.5 times the maximum service pressure (P_{ms}), the test being carried out at 55 ± 2 °C.

For carbon dioxide (CO_2) type extinguishers:

1) 1.5 times the maximum service pressure (P_{ms}), the test being carried out at 27± 5 °C; and
2) 1.25 times the maximum service pressure (P_{ms}), the test being carried out at 55 ± 5 °C.

9.8.4 A hose assembly without a shut-off nozzle shall be capable of withstanding, without leakage, a hydrostatic pressure equal to the extinguisher test pressure, (P_t) held for at least 30 s.

9.9 Method of Operation (Batch Test)

9.9.1 The extinguisher shall be operated by piercing, opening and/or breaking a sealing device, thus releasing its contents. Extinguishers shall operate without inversion. It shall not be necessary for any movement of the actuating mechanism to be repeated in order to initiate discharge of the extinguisher. The forces or the energy necessary to operate the extinguisher shall not exceed the values given in Table 10 for temperatures up to 55 °C.

Table 10 Force or Energy Required to Operate the Extinguisher

(*Clause* 9.9.1)

Sl No.	Type of Operation	Maximum Force Required N	Energy J
(1)	(2)	(3)	(4)
i)	With one finger	100	—
ii)	With full hand	200[1]	—
iii)	With impact (strike knob)	—	2

[1] For carbon dioxide extinguishers, this maximum force may be increased to 300 N.

9.9.2 The energy of 2 J is obtained by allowing the 4 kg mass used in the mechanical resistance (impact) test described in **7.5.1** to fall from a height of 50 mm. The impact shall be applied in the direction of the operating mode.

9.10 Safety-Locking Devices (Batch Test)

9.10.1 The operating mechanism shall be provided with a safety device to prevent inadvertent operation. The release of the safety device with tamper indicator shall involve an operation distinct from that of the operation mechanism and shall require a force of no less than 20 N but not exceeding 100 N. It shall be possible to determine whether the apparatus may have been operated.

9.10.2 The safety-locking device shall be made of a corrosion resistant material.

9.10.3 The safety-locking pin or other device shall be visible from the front of the extinguisher when the extinguisher is mounted in its mounting bracket.

> EXCEPTION — The safety-locking pin may be on the reverse side of the extinguisher if pictographic operating instructions on the front illustrate the intended method of operation.

9.10.4 If the safety-locking device is attached to the extinguisher by a chain or similar device, the chain shall be attached so as to not interfere with the discharge stream.

9.10.5 A tamper indicator such as a seal shall be provided to retain the safety-locking device in place and to indicate tampering with or use of the extinguisher.

9.10.6 The tamper indicator shall be constructed so that it must be broken to operate the extinguisher. The force required to break the tamper indicator shall not exceed 70 N.

> EXCEPTION — If the tamper indicator is broken by the action needed to start discharge of the extinguisher, or if an internal load is continuously applied to the release mechanism, the force required to accomplish discharge or release of the internal load may exceed 70 N, but shall not exceed 140 N.

9.11 Requirements for Pressure Gauges and Indicators for Low-Pressure Extinguishers

9.11.1 *General*

9.11.1.1 A rechargeable extinguisher of the stored-pressure type (except carbon dioxide) employing a single chamber for both the extinguishing medium and the expellant gas shall be equipped with a pressure gauge to show the amount of pressure in the chamber regardless if the valve is opened or closed.

9.11.1.2 The operable pressure range of the gauge shall reflect preferably the operating temperature-pressure relationship of the extinguisher (*see* **7.1**).

9.11.1.3 The pressure gauge face shall indicate the appropriate units for which the gauge is calibrated, such as bar, or kPa, or any other of pressure units.

9.11.1.4 The minimum indicated range of the pressure in the gauge shall be 0 to 20 bar.

The gauge dial shall indicate, in green, the operable pressure range of the extinguisher. The zero, service, and maximum indicated gauge pressures shall be shown with suitable marks. The arc of the dial from the zero pressure point to the lower end of the operable range shall read 'Recharge' or suitably marked. The arc of the dial from the higher end of the operable range to the maximum indicated pressure shall read 'Overcharged' or suitably marked. The area of service pressure range shall be marked with suitable colour. All numerals, letters, and characters in the recharge, operable, and overcharge portions of the dial shall be marked with any distinguished colour. Pointers shall be of prominent colour preferably contrast to the base colour, and the tip of the pointer shall end in the arc.

9.11.2 *Calibration Test — Gauges and Indicators*

Calibrate the pressure gauge by standard method from a NABL accredited laboratory. Alternatively, the calibration certificate of manufacturer of gauges and indicators shall also be accepted.

9.11.3 *Burst Strength Test — Gauges and Indicators*

9.11.3.1 A pressure gauge or an indicator shall withstand, for 1 min, a pressure of minimum 25 kg/cm^2 without rupture.

9.11.3.2 Attach the sample gauge or indicator to a hydraulic pressure pump after all air has been excluded from the test system. Place the sample in a test cage and apply pressure slowly (preferably at a rate of approximately 2.0 MPa/min) until the required test pressure is reached. Hold the pressure at this point for 1 min.

9.11.4 *Water Resistance Test — Gauges and Indicators*

A gauge or indicator for use on an extinguisher shall remain watertight after being immersed at a depth of 0.3 m in water for 2 h, and after being subjected to the salt-spray corrosion test (*see* **7.6.1**).

9.12 Dip-Tubes and Filters — Water-Based Extinguishers

9.12.1 The dip-tube and filter of water-based extinguishers shall be constructed of materials resistant to the extinguishing medium (*see* **9.7.3**).

9.12.2 The extinguishing medium from water-based extinguishers shall be discharged through a filter. The filter shall be placed upstream of the smallest section of the discharge passage. Each orifice of the filter shall have an area less than that of the smallest cross-section of the discharge passage. The total area of the combined filter orifices shall be at least equal to five times the smallest section of the discharge passage.

9.13 Horn Test for Carbon Dioxide (CO_2) Extinguishers (Type Test)

The extinguisher horn shall withstand crushing when 25 kg is applied to its extremity for 5 min immediately after having completely discharged the extinguisher through the horn.

Subject the horn to the following test:

a) Condition the horn at 55 °C for 18 h;
b) Attach the horn to a fully charged extinguisher;
c) Discharge the extinguisher with the valve fully open;
d) Subject the horn to a static load of 25 kg using a circular contact surface of 50 mm diameter for 5 min applied at the end of the horn; and
e) Check that the horn does not show any evidence of cracking or breakage.

9.14 Requirements for Extinguishants Filled in the Extinguisher

9.14.1 For ABC powder type extinguisher, the content of mono ammonium phosphate shall not be less than 40 percent when tested as per method given in IS 4308.

9.14.2 For BC powder type extinguisher, the content of sodium bicarbonate/potassium bicarbonate shall not be less than 75 percent when tested as per method given in IS 4308.

9.14.3 For foam type extinguisher, the surface tension shall not be more than 18 dyne/cm when tested as per the method given in IS 4989.

10 MARKING AND COLOUR

10.1 Colour

The recommended colour for extinguisher bodies is red conforming to shade No. 536 or 538 of IS 5. A small band of distinguishing colour of approx 5 percent/ prominent of surface area shall be painted for different type of extinguishers as given below:

Extinguishers	*Band Colour*
Water based extinguishers	Red
Foam based extinguishers	Yellow
Powder based extinguisher	Blue
Carbon dioxide based extinguishers	Black
Clean agent extinguishers	Green
Water mist extinguishers	Red

10.2 Marking

NOTE — An example of the layout for marking is given in Fig. 7.

10.2.1 *General*

10.2.1.1 The operating, recharging, and inspection and maintenance instructions shall be in the form of an etched or embossed metal nameplate or band, or an acceptable pressure-sensitive nameplate attached to the side of the extinguisher body, or in the form of silk-screening of paint directly on the extinguisher body or in the form of label. The marking shall identify the extinguisher as to type of media and shall include the manufacturer's name and model number and the rating and classification of the fire extinguisher.

10.2.1.2 The marking shall include a sequential serial number.

10.2.1.3 The year of manufacture, or the last two digits of the calendar year, and the factory test pressure shall be permanently marked into the extinguisher body or non-transferable nameplate. Extinguishers manufactured in the last three months of a calendar year may be marked with the following year as the date of manufacture, and extinguishers manufactured in the first three months of a calendar year may be marked with the previous year as the date of manufacture.

10.2.1.4 The marking shall include a reference to the range of temperatures at which the extinguisher is usable, such as 'Acceptable to use at temperature from …°C to …°C' or the equivalent.

10.2.1.5 The following applicable statement or the equivalent shall be included in the marking:

a) For rechargeable extinguishers: 'Recharge immediately after any use'; and
b) For disposable extinguishers: 'Discard immediately after any use'.

10.2.1.6 The gas cartridge shall be permanently marked with the following:

a) Empty mass, in g;
b) Nominal full mass, in g;
c) Year of manufacture; and
d) Name or code of the manufacturer.

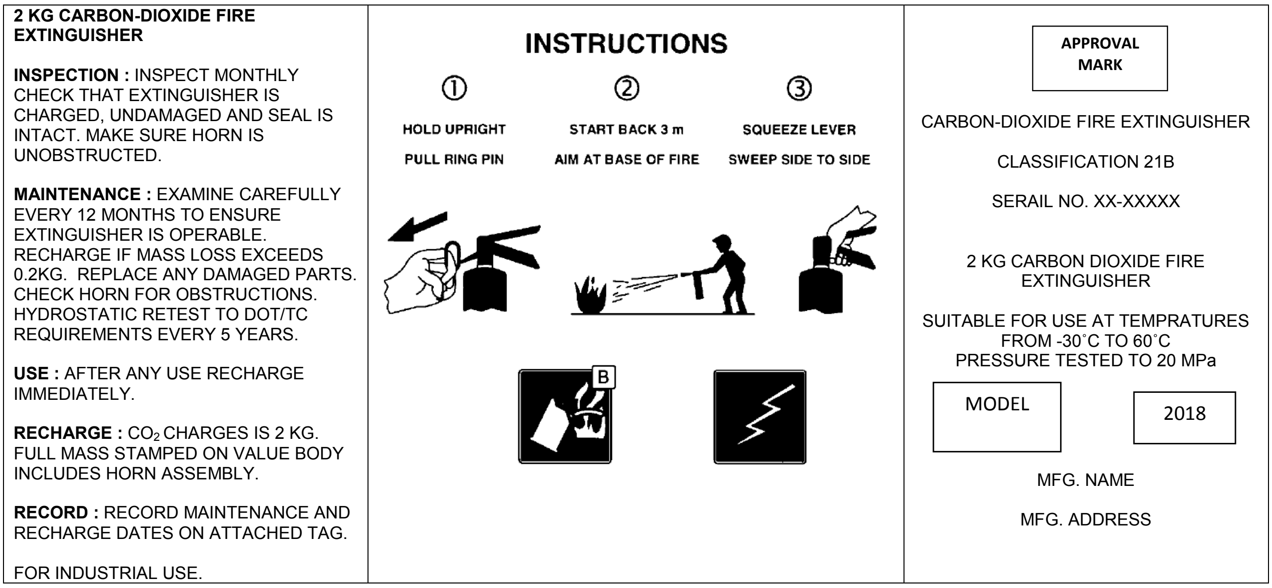
The above information may be placed on the cartridge in the form of a decalcomania transfer if the cartridge is mounted on the outside of the extinguisher media chamber. If the cartridge is mounted inside the media chamber, this information shall be stenciled or stamped on the cartridge.

10.2.1.7 The marking on each extinguisher shall include its exact gross mass or minimum and maximum gross mass, which may be expressed by a tolerance. The gross mass shall include the mass of the charged extinguisher and discharge assembly.

10.2.1.8 The chemical name of the clean agent shall be marked on the label of the clean agent extinguisher.

10.2.1.9 *BIS certification marking*

The extinguisher may also be marked with the Standard Mark.



2 KG CARBON-DIOXIDE FIRE EXTINGUISHER

INSPECTION : INSPECT MONTHLY CHECK THAT EXTINGUISHER IS CHARGED, UNDAMAGED AND SEAL IS INTACT. MAKE SURE HORN IS UNOBSTRUCTED.

MAINTENANCE : EXAMINE CAREFULLY EVERY 12 MONTHS TO ENSURE EXTINGUISHER IS OPERABLE. RECHARGE IF MASS LOSS EXCEEDS 0.2KG. REPLACE ANY DAMAGED PARTS. CHECK HORN FOR OBSTRUCTIONS. HYDROSTATIC RETEST TO DOT/TC REQUIREMENTS EVERY 5 YEARS.

USE : AFTER ANY USE RECHARGE IMMEDIATELY.

RECHARGE : CO_2 CHARGES IS 2 KG. FULL MASS STAMPED ON VALUE BODY INCLUDES HORN ASSEMBLY.

RECORD : RECORD MAINTENANCE AND RECHARGE DATES ON ATTACHED TAG.

FOR INDUSTRIAL USE.

INSTRUCTIONS

① HOLD UPRIGHT
PULL RING PIN

② START BACK 3 m
AIM AT BASE OF FIRE

③ SQUEEZE LEVER
SWEEP SIDE TO SIDE

APPROVAL MARK

CARBON-DIOXIDE FIRE EXTINGUISHER

CLASSIFICATION 21B

SERAIL NO. XX-XXXXX

2 KG CARBON DIOXIDE FIRE EXTINGUISHER

SUITABLE FOR USE AT TEMPRATURES
FROM -30˚C TO 60˚C
PRESSURE TESTED TO 20 MPa

MODEL

2018

MFG. NAME

MFG. ADDRESS

FIG. 7 EXAMPLE OF LAYOUT MARKING FOR AN EXTINGUISHER

10.2.1.9.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder. The details of the conditions under which the licence for use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

10.2.2 *Operating Instructions*

10.2.2.1 For the purpose of applying the requirements of this section, the 'operating instructions' are defined as those necessary to accomplish intended discharge of the extinguishing media including any warnings. An example of the layout marking is given in Fig. 7.

10.2.2.2 Clean-agent fire extinguishers shall contain the following warning or equivalent as part of the operating instructions:

> **WARNING** — The concentrated agent when applied to the fire can produce toxic by-products. Avoid inhalation of these materials by evacuating and ventilating the area.

10.2.2.3 The operating instructions shall face outward and cover no more than a 120° arc on the extinguisher body. The marking required in **10.2.2.4** and **10.2.3** shall together occupy a minimum surface area of 75 cm^2 for an extinguisher having a diameter greater than 80 mm and 50 cm^2 for and extinguisher having a diameter of 80 mm or less.

10.2.2.4 The operating instructions shall be arranged as follows:

a) Word 'INSTRUCTIONS' shall be at the top of the nameplate. The minimum letter height shall be 6.0 mm for an extinguisher having a diameter greater than 80.0 mm and 5.0 mm for an extinguisher having a diameter of 80.0 mm or less. As an option, the words FIRE EXTINGUISHER or EXTINGUISHER may be added to the word INSTRUCTIONS;

b) Operating instructions shall be in the form of numerically sequenced pictographs. A single pictograph may include two instructions;

c) Sequence of pictographs shall illustrate, with pictures, the recommended actions necessary for intended operation of the extinguisher. Words may be added. The sequence shall be as follows:

   1) Making ready the extinguisher by disengaging the safety-locking device;

   2) Aiming the extinguisher at the base of the fire, including the recommended distance from the fire at which to begin discharge, and indicating the intended operating attitude of the extinguisher;

   3) Taking whatever action necessary to initiate operation of the extinguisher; and

   4) Describing the intended method of applying the extinguishing media on the fire.

10.2.2.5 The extinguisher shall be marked with letters 'A', 'B' and 'C' indicating their suitability for respective class of fires as laid down in IS 2190, and numerical indicating size of fire such 2A and 21B, etc.

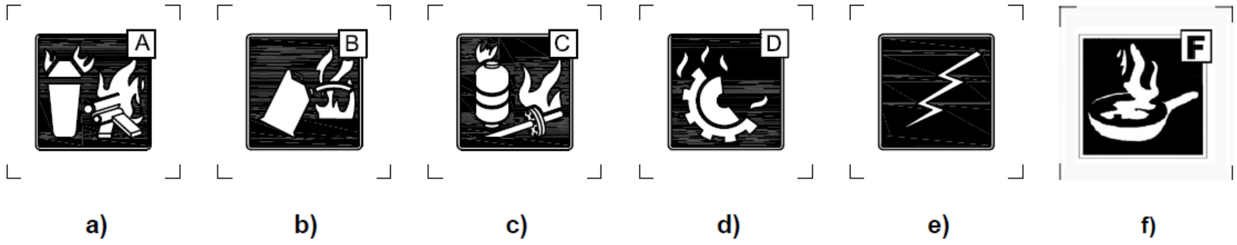
10.2.3 *Use Code Symbols*

10.2.3.1 Use code symbols (*see* Fig. 8) shall be positioned directly below the operating instructions. A written description for each use code symbol may be included as part of the code. The description should be readable.

10.2.3.2 Use code symbols shall be placed on the extinguisher for those types of fires for which the extinguisher is classified.

10.2.4 *Recharging Instructions*

The recharging instructions on the marking of a rechargeable extinguisher shall state the intended mass and agent that shall be used in recharging, the



a) class A: Ordinary solid material fires
b) class B: Flammable liquid fires
c) class C: Gas and vapour fires
d) class D: Combustible metal fires
e) class E: Fires involving energized electrical conductors
f) class F: Cooking oil fires

FIG. 8 USE CODE SYMBOLS

intended expellant gas pressure or the use of a correct and a fully charged gas cartridge. Reference shall be made to use only the manufacturer's replacement parts in recharging the extinguisher. However, in lieu of detailed recharge instructions, these instructions may simply instruct the user to return the extinguisher to the dealer or manufacturer for recharging, using the following words or the equivalent: 'Return to an authorized recharger for recharging in accordance with Service Manual No…'.

It is mandatory to recharge the extinguisher by manufacturer or authorized agent of manufacturer.

10.3 Inspection Instructions

The inspection instructions shall state that the extinguisher is to be checked to ensure that,

a) the seals and tamper indicators are not broken or missing;
b) it is full (by weighing or lifting);
c) it is not obviously damaged, corroded, leaking or has a clogged nozzle; and
d) its pressure gauge reading or indicator is in the operable range or position.

11 MANUALS

11.1 User Manual and Service Manual

A user manual shall be provided with each extinguisher. This manual shall contain the necessary instructions, warnings, and cautions for the intended installation, operation and inspection of the extinguisher. The manual shall also refer the manufacturer's service manual for maintenance and recharging of the extinguisher.

The manufacturer shall prepare a service manual for each model fire extinguisher. It shall be made available upon request and shall,

a) contain necessary instruction, warnings, and cautions, a description of servicing equipment, and a description of recommended operations for intended servicing;
b) provide a list of part numbers of all replaceable parts; and
c) indicate that the pressure gauge attached to the extinguisher shall not be used to determine when the intended service pressure has been reached, and a pressure regulator shall be used if the pressure service is a tank of high pressure gas.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
5 : 2007	Colours for ready mixed paints and enamels (*sixth revision*)
1708 (Part 1) : 1986	Methods of testing of small clear specimens of timber: Part 1 Determination of moisture content (*second revision*)
2190 : 2010	Selection, installation and maintenance of first-aid fire extinguishers — Code of practice (*fourth revision*)
4308 : 2018	Dry chemical powder for fire fighting — BC, ABC and D types — Specification (*third revision*)
4947 : 2006	Specification for gas cartridges for use in fire extinguishers (*third revision*)
4989 : 2018	Foam concentrate for producing mechanical foam for fire fighting — Specification (*fourth revision*)
7285	Refillable seamless steel gas cylinders — Specification
(Part 1) : 2018	Normalized steel cylinders (*fourth revision*)
(Part 2) : 2017	Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa (112 kgf/mm²) (*fourth revision*)
7673 : 2004	Fire fighting equipment — Glossary of terms (*first revision*)
11864 : 1986	Recommended construction practice of apparatus for spray cabinet for various salt spray tests
15222 : 2002	Carbon dioxide as fire extinguishing media for fire protection — Specification
15660 : 2017	Refillable transportable seamless aluminium alloy gas cylinder — Specification (*first revision*)

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Fire Fighting Sectional Committee, CED 22

Organization	*Representative(s)*
Ministry of Home Affairs, New Delhi	Shri D. K. Shami (***Chairman***)
Agni Controls, Chennai	Shri D. Balachandran
Airports Authority of India, New Delhi	Shri Subhash Kumar Shri P. K. Deshmukh (*Alternate*)
Bhabha Atomic Research Centre, Mumbai	Chief Fire Officer
CSIR-Central Building Research Institute, Roorkee	Dr R. S. Chimote Shri Suvir Singh (*Alternate*)
Central Industrial Security Force, New Delhi	Shri Rajnath Singh Shri S. D. Ingle (*Alternate*)
Central Public Works Department, New Delhi	Shri Chaitanya Kumar Verma Shri D. K. Tulani (*Alternate*)
Centre for Fire & Explosive Environment Safety (DIFR), New Delhi	Shri V. K. Sharma Shri M. K. Jain (*Alternate*)
Chennai Petroleum Corporation Ltd, Chennai	Shri J. P. K. Hepat
Chhatariya Rubber & Chemicals Industries, Mumbai	Shri S. A. Haveliwala Shri H. S. Haveliwala (*Alternate*)
Controllerate of Quality Assurance, Pune	Col V. V. Kadam Col N. K. N. Rao (*Alternate*)
Delhi Fire Services, New Delhi	Shri A. K. Sharma Dr G. C. Misra (*Alternate*)
Directorate of Fire and Emergency Services, Goa	Shri Ashok Menon Shri Rajendra A. Haldankar (*Alternate*)
Engineer-in-Chief's Branch, New Delhi	Dr Ram Verma Shri V. K. Gulati (*Alternate*)
Engineers India Ltd, New Delhi	Shri R. B. Bhutda Shri Vipan Goel (*Alternate*)
F. M. Engineering International India Branch, Bengaluru	Shri Sumit Khanna Shri Prasad Kulkarni (*Alternate*)
Fire & Emergency Services, J&K, Srinagar	Dr G. A. Bhat
Fire Protection Association of India, Mumbai	President
GAIL (India) Limited, New Delhi	Shri S. P. Garg Shri Sanjeev Kumar Kalkal (*Alternate*)
Gunnebo India Pvt Limited, Chennai	Shri K. Arul Prakash Shri Rajesh Sharma (*Alternate*)
H. D. Fire Protect Pvt Limited, Thane	Shri Harish N. Dharamshi Shri K. T. Chaudhari (*Alternate*)
Indian Oil Corporation Limited, Noida	Shri Aashish R. Gokhale
Institution of Fire Engineers, New Delhi	President General Secretary (*Alternate*)
K. V. Fire Chemicals (India) Pvt Ltd, Navi Mumbai	Shri Rajesh H. Sabadra Shri Uday K. Shroff (*Alternate*)

Organization	*Representative(s)*
Karnataka State Fire and Emergency Services, Bengaluru	SHRI K. U. RAMESH SHRI K. SRINIVASA (*Alternate*)
Maharashtra Fire Services, Mumbai	DIRECTOR SHRI S. S. WARICK (*Alternate*)
Mumbai Fire Brigade, Mumbai	SHRI S. V. JOSHI
NBCC (India) Limited, New Delhi	SHRI R. K. AGARWAL SHRIMATI SUNITA PURSWANI (*Alternate*)
Nohmi Bosai (India) Pvt Ltd, Gurugram	SHRI ISHWAR IYER SHRI NEERAJ SEHGAL (*Alternate*)
Oil Industry Safety Directorate, New Delhi	SHRI S. K. NANDY
Reliance Industries Limited, Mumbai	SHRI VARADENDRA KOTI SHRI UMESH KHANDALKAR (*Alternate*)
RESQ Technologies, Ahmedabad	SHRI ROHIT V. SHAH
Safex Fire Services Limited, Mumbai	SHRI JITENDRA SHAH SHRI SANDIP SHAH (*Alternate*)
Shah Bhogilal Jethalal & Bros, Ahmedabad	SHRI MUKESH M. SHAH SHRI ABHAY D. PURANDARE (*Alternate*)
State Bank of India, Mumbai	SHRI VIJAY S. NALHE
Surex Production and Sales Private Limited, Kolkata	SHRI DEBASHIS NEOGI
Swastik Synergy Engineering Pvt Ltd, Mumbai	SHRI MUKESH D. SHAH SHRI KUNAL ZATAKIA (*Alternate*)
Tamil Nadu Fire and Rescue Services Department, Chennai	SHRI S. VIJAYASEKAR SHRIMATI N. PRIYA (*Alternate*)
Tyco Fire & Security India Pvt Ltd, Mumbai	SHRI MANOJ SHENOY SHRI RIYAZUDDIN SIDDIQUI (*Alternate*)
UL India Pvt Limited, Bengaluru	SHRI JAGDISH V SHRI S. P. TEJ KUMAR BEHARA (*Alternate*)
Uttar Pradesh Fire Services, Lucknow	SHRI P. K. RAO SHRI AMAN SHARMA (*Alternate*)
West Bengal Fire and Emergency Service, Kolkata	SHRI D. P. BISWAS SHRI G.K. BHATTACHARYA (*Alternate*)
In personal capacity, *(B-152, Ist Floor, East of Kailash, New Delhi)*	SHRI HEMANT KUMAR
In personal capacity (K-*33-A, Green Park, New Delhi*)	SHRI S. K. DHERI
In personal capacity (*A-45, Sector-70, Noida*)	DR H. S. KAPRWAN
In personal capacity (*A-347, Defence Colony, New Delhi*)	SHRI R. C. SHARMA
In personal capacity (*SJR Verity, VIVA-305, Amrita College Road, Bengaluru*)	SHRI T. R.A. KRISHNAN
BIS Directorate General	SHRI SANJAY PANT, SCIENTIST 'F' AND HEAD (CIVIL ENGINEERING) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary

SHRI SRIKANTH YAJJALA
SCIENTIST 'C' (CIVIL ENGINEERING), BIS

Fire Fighting Equipments Including Water Fittings Subcommittee , CED 22:2

Organization	*Representative(s)*
In Personal Capacity (*A-45, Sector-70, Noida*)	Dr H. S. Kaprwan (***Convener***)
ASKA Equipment Ltd, New Delhi	Shri Ashok H. Garg
Ceasefire Industries Limited, New Delhi	Shri Ashutosh Mangal
Centre for Fire & Explosive Environment Safety (DIFR), New Delhi	Shri V. K. Sharma Shri M. K. Jain (*Alternate*)
Chennai Petroleum Corporation Limited, Chennai	Shri J. P. K. Hepat
Chhatriya Rubbers Chemicals Industries, Mumbai	Shri S. A. Haveliwala Shri H. S. Haveliwala (*Alternate*)
Controllerate of Quality Assurance, Pune	Col V. V. Kadam Col N. K. N Rao (*Alternate*)
Delhi Fire Services, New Delhi	Shri A. K. Sharma Dr G. C. Misra (*Alternate*)
Devraj Engineers, Ahmedabad	Shri Vaishnav B. Shah Shri Devan B. Shah (*Alternate*)
Fire & Emergency Services, Goa	Shri Ashok Menon
G. K. Engg Co Limited, New Delhi	Shri A. K. Dhawan
Gunnebo India Pvt Limited, Chennai	Shri K. Arul Prakash Shri Rajesh Sharma (*Alternate*)
H. D. Fire Protect Pvt Limited, Thane	Shri Harish N. Dharamshi Shri K. T. Chaudhari (*Alternate*)
Institution of Fire Engineers (India), New Delhi	President General Secretary (*Alternate*)
K. V. Fire Chemicals (India) Pvt Ltd, Navi Mumbai	Shri Rajesh H. Sabadra Shri Uday K. Shroff (*Alternate*)
Kochi Refineries Limited, Ernakulam	Shri A. K. Das
Ministry of Home Affairs, New Delhi	Shri D. K. Shami Deputy Fire Adviser (*Alternate*)
Municipal Corporation of Greater Mumbai, Mumbai	Chief Fire Officer Deputy Chief Fire Officer (*Alternate*)
Newage Industries, Surendranagar	Shri Ashok M. Shah
Nitin Fire Proetection Industries Limited, Mumbai	Shri Nitin M.Shah Shri Kunal N. Shahi (*Alternate*)
Peter Autokits Pvt Limited, Mumbai	Shri J. K. Shah Shri Paresh Joshi (*Alternate*)
S & P Safety Products Pvt Limited, Kolkata	Shri Tunir Chakrabarti
Safex Fire Services Limited, Mumbai	Shri Jitendra Shah Shri Sandip Shah (*Alternate*)
Shah Bhogilal Jethalal & Bros, Ahmedabad	Shri Mukesh M. Shah Shri Abhay D. Purandare (*Alternate*)
Super Star Fire Tech Pvt Limited, Vadodara	Shri Rohit Mehta Shri Tushar Mehta (*Alternate*)
Surex Production and Sales Private Limited, Kolkata	Shri Debashis Neogi
Topaz Fire Systems Pvt Ltd, Bengaluru	Shri Liaqut Ali Khan

Organization	*Representative(s)*
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In personal capacity (*A-347, Defence Colony, New Delhi)*	SHRI R. C. SHARMA
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